

WHAT IS CLAIMED:

1. A method for using a display having a predetermined display resolution to show out of focus areas in an archival image having a greater resolution than the predetermined display resolution, the method comprising the steps of:

providing a verification image sized for presentation on the display;

identifying portions of the archival image that are out of focus; and,

blurring the verification image so that portions of the verification image that correspond to out of focus portions of the archival image appear out of focus when the verification image is presented on the display.

2. The method of claim 1 wherein the step of providing the verification image comprises subjecting the archival image to a frequency domain transform to generate AC frequency domain transform coefficients; and using the AC frequency transform coefficients to form the verification image.

3. The method of claim 2 wherein the step of identifying out of focus portions of the archival image further comprises subjecting at least some of the AC transform coefficients to a threshold test to define blur map identifying areas of the archival image that are out of focus.

4. The method of claim 1 wherein the step of identifying the portions of the archival image that are out of focus comprises:

processing the archival image to produce a blur map indicating the portions of the archival image that are out of focus.

5. The method of claim 2 wherein the step of identifying out of focus portions of the archival image further comprises the steps of applying multiple threshold tests to the AC coefficients to generate multi-level blur maps,

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and comparing the multi-level blur maps to identify the extent to which various portions of the archival image are out of focus.

6. The method of claim 1 wherein the step of blurring the verification image further comprises modifying the verification image so that when the verification image is presented on the display, portions of the verification image that correspond to portions of the archival image that are relatively more out of focus appear to be more out of focus than portions of the archival image that are relatively less out of focus.

7. The method of claim 1 wherein the step of identifying the out of focus portions of the archival image comprises the steps of:

generating a luminance image based upon the archival image, creating a high pass image of the luminance image, resampling the high pass luminance image to form a high pass luminance image at display resolution, using the threshold test to generate a blur selection map, and using the blur selection map to identify portions of the archival image that are out of focus.

8. The method of claim 7 further comprising the steps of applying multiple threshold tests to the compressed high pass luminance image to generate multiple blur maps and comparing the blur maps to identify the extent to which various portions of the archival image are out of focus.

9. The method of claim 8 wherein the step of blurring the verification image further comprises the step of modifying the verification image so that when the verification image is displayed, portions of the verification image that correspond to portions of the archival image that are relatively more out of focus appear to be more out of focus than portions of the verification image that are relatively less out of focus.

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10. The method of claim 8 wherein the step of blurring the verification image comprises adaptively resampling the archival image based upon the blur selection map.

11. The method of claim 1 wherein the step of blurring the verification image further comprises using a contrast sensitivity function, based upon the distance from the viewer to the display and the imaging resolution and the size of the display, to determine the extent to which portions of the verification image must be blurred so that they appear out of focus when the verification image is displayed on the display.

12. The method of claim 11 wherein the step of blurring the verification image further comprises reducing the spatial frequencies in the range of between 0.08 cycles per sample to 0.5 cycles per sample

13. The method of claim 11 wherein the step of blurring the verification image further comprises reducing the spatial frequencies in the range of between 1.3 cycles per degree to 8.4 cycles per degree.

14. The method of claim 1 wherein the step of identifying which portions of the archival image are out of focus comprises the steps of:
portioning the archival image into multiple range finding spots;
obtaining a range finding distance for each spot; and
using the range finding distance for each spot to identify whether the portion of the archival image associated with each spot is out of focus.

15. The method of claim 14, wherein the step of using the range finding distance for each spot to identify whether the portion of the out of the archival image associated with each spot is out of focus comprises:

obtaining the focussed distance of an image sensor and a lens taking unit that focuses light on to the image sensor,

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determining the depth of field of the image sensor and lens taking unit; and

determining that a spot is out of focus based upon the range finding distance, the focussed distance and the depth of field.

16. The method of claim 1 further comprising the step of identifying the extent to which portions of the archival image are out of focus wherein the steps of providing a verification image and blurring the verification image comprises adaptively resampling the archival image to form a verification image having corresponding portions that appear to be proportionately more out of focus.

17. The method of claim 1 wherein the step of blurring the verification image comprises defining at least one set of subdivisions within each out of focus area of the verification image and averaging the chrominance and luminance values within each sub-division, and wherein the size of the subdivisions is defined so that they create a visible blur in the verification image when the verification image is presented on the display.

18. The method of claim 17 further comprising the step of identifying the extent to which portions of the archival image are out of focus and wherein proportionately larger subdivisions are defined within portions of the verification image that are relatively more out of focus and wherein smaller subdivisions are defined within portions of the verification image that are more in focus.

19. The method of claim 1, wherein the step of blurring the verification image comprises applying at least one blur kernel to the out of focus area with said blur kernel defined so that it creates a visible blur in the verification image when the verification image is presented on the display.

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20. The method of claim 19 further comprising the step of identifying the extent to which portions of the archival image are out of focus wherein more than one blur kernel is applied to the verification image with each of the blur kernels inducing a different relative amount of apparent blur in the verification image and with the blur kernels applied so that portions of the verification image that are more out of focus appear to be proportionately more out of focus.

21. The method of claim 1 further comprising the step of detecting a digital zoom setting wherein the step of identifying out of focus portions comprise identifying portions of the archival image that will be out of focus when the archival image is enlarged to the digital zoom setting.

22. The method of claim 1 further comprising the step of detecting a digital zoom setting wherein the step of identifying out of focus portions comprise identifying portions of the archival image that will be out of focus when the archival image is enlarged to the anticipated output size.

23. A method for forming a verification image that indicates out of focus portions of an archival image using a display having a resolution that is lower than the resolution of the archival image, the method comprising the steps of:

- obtaining an archival image;
- generating a luminance image based upon the obtained archival image;
- resampling the luminance image to form a high pass luminance image at display resolution;
- generating a blur map corresponding to the resampled display resolution image by applying a threshold test to the high pass luminance image;
- providing a display resolution image matching the appearance of the archival image; and

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blurring the display resolution image in accordance with the blur map resolution image so that out of focus areas in the display resolution image appear to be out of focus when viewed on the display.

24. The method of claim 23 wherein the step of generating a luminance image comprises applying a finite impulse response high pass filter to the archival image.

25. The method of claim 24 further comprising the steps of detecting conditions including the focal length of the optical system used to capture the archival image, the depth of field of the archival optical system, and the focus distance of the archival optical system wherein the step of generating a luminance image comprises using the detected conditions to select a finite impulse high pass filter that is adapted for such conditions and applying the selected finite impulse high pass filter to the verification image to induce blur.

26. The method of claim 24 wherein the threshold is determined by applying a histogram to the display resolution high-pass luminance image and determining a threshold value that identifies a predetermined percentage of the image data as being out of focus.

27. The method of claim 23 wherein the step of generating a blur map comprises applying more than one threshold to the high pass display resolution display image to generate multiple blur maps and comparing the blur maps to identify portions of the archival image that are more out of focus than other portions of the archival image that are out of focus.

28. The method of claim 26 further comprising the step of blurring the resampled display resolution image to a greater apparent extent in portions that correspond to portions of the archival image that are more out of

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focus than in portions of the resampled display resolution image that correspond to the other portions of the archival image.

29. The method of claim 23, wherein the steps of providing the display resolution image and blurring the display resolution image comprise adaptively resampling the archival image in accordance with the blur map.

30. The method of claim 23 wherein the step of generating a blur map further comprises detecting a digital zoom signal and selecting a threshold based upon the digital zoom signal.

31. The method of claim 23 wherein the step of generating a blur map further comprises detecting a pseudo zoom setting and selecting a threshold based upon the pseudo zoom signal.

32. The method of claim 23 wherein the step of generating a blur map further comprises detecting a setting indicating the anticipated size of the rendered output image and selecting a threshold based upon the signal.

33. A method for forming a verification image that indicates out of focus portions of an archival image using a display having a resolution that is lower than the resolution of the archival image, the method comprising the steps of:

- obtaining archival image capture settings at a defined moment;
- obtaining an electronic image at a defined moment;
- using the archival image capture settings to modify the appearance of the electronic image to form a verification image matching the appearance of the archival image;
- identifying out of focus areas in the archival image; and,
- blurring the verification image in areas of the verification image that correspond to out of focus areas in the archival image.

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34. The method of claim 33 wherein the archival image is captured by an archival image capture system and the electronic image is captured by an electronic image capture system.

35. The method of claim 34 wherein the step of identifying out of focus portions of the archival image comprises detecting a focus distance and depth of field for the archival image capture system at the defined moment, detecting the distance from the camera to various portions of the scene at the defined moment and determining whether the focus distance is within a distance that is defined between the near depth of field and far depth of field of the archival image.

36. A camera system for capturing an archival image and displaying a verification image, the camera system comprising:

- a digital image capture system for capturing an archival image having a predetermined imaging resolution;

- a display having a display resolution lower than the predetermined imaging resolution for presenting a verification image; and

- a signal processor receiving the archival image, forming the verification image, identifying portions of the archival image that are out of focus and modifying the verification image so that when the verification image is displayed on the display portions of the verification image that correspond to portions of the archival image that are out of focus, appear out of focus.

37. The camera of claim 36, wherein the signal processor identifies portions of the archival image that are out of focus by image analysis of the archival image.

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38. The camera of claim 37, wherein the signal processor identifies portions of the archival image that are out of focus using at least one blur map.

39. The camera of claim 37, wherein the signal processor identifies portions of the archival image that are out of focus using at least one blur map.

40. The camera of claim 37, wherein the signal processor identifies portions of the archival image that are relatively more out of focus and relatively less out of focus and modifies the verification image so that areas that are more out of focus appear to be more out of focus when displayed on the display.

41. The camera of claim 36, further comprising a multi-spot rangefinder that determines the distance from the camera to various portions of a scene captured as an archival image wherein the signal processor identifies whether each portion is out of focus on the basis of the distance from the camera to that portion of the scene.

42. A camera system comprising a source of an archival image having a predetermined resolution, a verification display having an image display resolution that is lower than the predetermined resolution of the archival image and a signal processor, with said signal processor processing the archival image to identify out of focus portions of the archival image and to form a verification image formatted for presentation on the verification display, so that portions of the verification image that correlate to identified portions of the archival image that appear out of focus when presented on the verification display.

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43. The camera system of claim 42 wherein the source of the archival images comprises a camera connected to the signal processor by way of an electronic data communications network.

44. The camera system of claim 42 wherein the source of the archival images comprises an analog camera connected to the signal processor by way of an electronic data communicating network.

45. The camera system of claim 43 wherein the source of the archival images comprises a digital camera.

46. The camera system of claim 43 wherein the source of the archival images comprises: an analog camera connected to an analog to digital converter.

47. A camera system for generating a verification image, the camera system comprising:

an image sensor to convert light incident on said sensor into a digital representation of an image formed on the image sensor, the image sensor having a depth of field;

a taking lens unit having an adjustable focus distance for focusing light on to the image sensor; and

a camera microprocessor for controlling the adjustment of the lens taking unit;

a rangefinder to determine a distance from the camera to various spots in a scene with the rangefinder determining a distance from the camera to a subject and setting the taking lens unit so that the image formed at the image sensor is focused at the distance defined by the rangefinder; and

a digital signal processor connected to the image sensor to receive the images captured by the image sensor, and forming an archival image and a

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verification image that is representative of the archival image and adapted for display on a video display having resolution lower than that of the image sensor,

wherein said digital signal processor uses rangefinding data and data regarding the focus distance of the taking lens unit to determine whether portions of the archival image are out of focus and modifies the display verification image so that portions of the verification image that correlate to out of focus portions of the archival image appear out of focus when the verification image is presented on the video display.

48. A camera system for generating a verification image for presentation on a video display having a predetermined display resolution the camera system comprising:

an archival image capture system having an optical system to controllably focus light from a scene onto an archival image capture surface to capture images of a scene at a resolution that is higher than the predetermined display resolution, the archival image capture system having a first depth of field and a first focus distance at the time of archival image capture;

a verification image capture system having an optical system to controllably focus light from the scene onto an electronic image capture surface to capture an electronic image of the scene at the time of archival image capture, the verification image capture system having a second depth of field and a second focus distance;

a range finder dividing the scene into a plurality of portions and determining an optimum focus distance for each portion;

a microprocessor to determine which portions of the captured archival image are out of focus based upon the optimum focus distance of each portion and the first focus distance and first depth of field of the archival image;

a signal processor to selectably blur portions of the verification image so that portions of the verification image that correspond to portions of the archival image that are out of focus appear out of focus in the verification image.

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49. The camera of claim 48, further comprising a digital zoom input having an active setting and wherein the microprocessor detects the active setting and determines which portions of the archival image are out of focus based at least in part upon the digital zoom active setting.

50. The camera of claim 48, further comprising a pseudo zoom input having an active setting and wherein the microprocessor detects the active setting and determines which portions of the archival image are out of focus based at least in part upon the pseudo zoom active setting.

51. The camera of claim 48, further comprising an anticipated rendered output size setting input and said microprocessor determines which portions of the archival image are out of focus based at least in part on the anticipated rendered output size setting.

52. The camera of claim 48 wherein said microprocessor generates a blur map identifying out of focus portions of the archival image and the signal processor selectably blurs portions of the verification image based at least in part on the blur map.

53. The camera of claim 52, wherein said signal processor determines for each portion of the verification image that corresponds to an out of focus portion of the archival image to determine whether the portion will appear out of focus and selectably blurs only those portions of the verification image that correspond to out of focus portions of the archival image and that will appear to be in focus when presented on the display if blur is not introduced by the signal processor.

54. The camera of claim 48 wherein the archival image capture surface comprises a photographic film.

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